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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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PATTERSON & SHERIDAN, LLP			WONG, EDNA	
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Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 10/616,097	Applicant(s) SUN ET AL.	
	Examiner Edna Wong	Art Unit 1753	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 02 May 2006.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 8-10,20-22,31-33 and 37-59 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 8-10,20-22,31-33 and 37-59 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|-------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input checked="" type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. <u>February 23, 2006</u> . |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____. | 6) <input type="checkbox"/> Other: _____. |

Continued Examination Under 37 CFR 1.114

A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on May 2, 2006 has been entered.

Response to Arguments

This is in response to the Amendment dated May 2, 2006. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

Claim Rejections - 35 USC § 103

I. Claims **8 and 9** have been rejected under 35 U.S.C. 103(a) as being unpatentable over **Miura et al.** (US Patent Application Publication No. 2003/0155247 A1) in combination with **Baskaran et al.** (US Patent Application Publication No. 2004/0072419 A1) ~~as applied to claims 1-7 and 34 above~~, and further in view of **Dubin et al.** (US Patent No. 6,432,821 B1).

The rejection of claims 8 and 9 under 35 U.S.C. 103(a) as being unpatentable over Miura et al. in combination with Baskaran et al. ~~as applied to claims 1-7 and 34~~

~~above~~, and further in view of Dubin has been withdrawn in view of Applicants' amendment.

II. Claim 10 has been rejected under 35 U.S.C. 103(a) as being unpatentable over **Miura et al.** (US Patent Application Publication No. 2003/0155247 A1) in combination with **Baskaran et al.** (US Patent Application Publication No. 2004/0072419 A1) as applied to ~~claims 1-7 and 34 above~~, and further in view of **Dubin et al.** (US Patent No. 6,432,821 B1) as applied to claims 8 and 9 above, and further in view of **Nagai et al.** (US Patent No. 6,709,563 B2).

The rejection of claim 10 under 35 U.S.C. 103(a) as being unpatentable over Miura et al. in combination with Baskaran et al. ~~as applied to claims 1-7 and 34 above~~, and further in view of Dubin et al. is as applied to claims 8 and 9 above, and further in view of Nagai et al. has been withdrawn in view of Applicants' amendment.

III. Claims 20 and 21 have been rejected under 35 U.S.C. 103(a) as being unpatentable over **Miura et al.** (US Patent Application Publication No. 2003/0155247 A1) in combination with **Baskaran et al.** (US Patent Application Publication No. 2004/0072419 A1) ~~as applied to claims 11, 13-15, 17-19 and 35 above~~, and further in view of **Dubin et al.** (US Patent No. 6,432,821 B1).

The rejection of claims 20 and 21 under 35 U.S.C. 103(a) as being unpatentable over Miura et al. in combination with Baskaran et al. ~~as applied to claims 11, 13-15, 17-~~

~~19 and 35 above~~, and further in view of Dubin et al. has been withdrawn in view of Applicants' amendment.

IV. Claim 22 has been rejected under 35 U.S.C. 103(a) as being unpatentable over **Miura et al.** (US Patent Application Publication No. 2003/0155247 A1) in combination with **Baskaran et al.** (US Patent Application Publication No. 2004/0072419 A1) as ~~applied to claims 11, 13-15, 17-19 and 35 above~~, and further in view of **Dubin et al.** (US Patent No. 6,432,821 B1) as applied to claims 20 and 21 above, and further in view of **Nagai et al.** (US Patent No. 6,709,563 B2).

The rejection of claim 22 under 35 U.S.C. 103(a) as being unpatentable over Miura et al. in combination with Baskaran et al. ~~as applied to claims 11, 13-15, 17-19 and 35 above~~, and further in view of Dubin et al. is as applied to claims 20 and 21 above, and further in view of Nagai et al. has been withdrawn in view of Applicants' amendment.

V. Claims 31 and 32 have been rejected under 35 U.S.C. 103(a) as being unpatentable over **Miura et al.** (US Patent Application Publication No. 2003/0155247 A1) in combination with **Baskaran et al.** (US Patent Application Publication No. 2004/0072419 A1) ~~as applied to claims 23-28, 30 and 36 above~~, and further in view of **Dubin et al.** (US Patent No. 6,432,821 B1).

The rejection of claims 31 and 32 under 35 U.S.C. 103(a) as being unpatentable

over Miura et al. in combination with Baskaran et al. ~~as applied to claims 23-28, 30 and 36 above~~, and further in view of Dubin et al. has been withdrawn in view of Applicants' amendment.

VI. Claim 33 has been rejected under 35 U.S.C. 103(a) as being unpatentable over **Miura et al.** (US Patent Application Publication No. 2003/0155247 A1) in combination with **Baskaran et al.** (US Patent Application Publication No. 2004/0072419 A1) ~~as applied to claims 23-28, 30 and 36 above~~, and further in view of **Dubin et al.** (US Patent No. 6,432,821 B1) as applied to claims 31 and 32 above, and further in view of **Nagai et al.** (US Patent No. 6,709,563 B2).

The rejection of claim 33 under 35 U.S.C. 103(a) as being unpatentable over Miura et al. in combination with Baskaran et al. ~~as applied to claims 23-28, 30 and 36 above~~, and further in view of Dubin et al. as applied to claims 31 and 32 above, and further in view of Nagai et al. has been withdrawn in view of Applicants' amendment.

Response to Amendment

Claim Rejections - 35 USC § 112

I. Claims 42, 44, 51, 57 and 59 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the

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application was filed, had possession of the claimed invention.

Claims 42, 51 and 57

lines 1-2, respectively of each, “a thickness of less than about 200 Å” is new matter.

Applicants’ specification discloses a thickness of about 100 Å (pages 15-18, Examples 1-5). A thickness of less than about 200 Å is not disclosed.

Claim 44

lines 1-3, “wherein the barrier layer comprises a material selected from the group consisting of cobalt, ruthenium, nickel, tungsten, tungsten nitride, titanium, titanium nitride, silver, alloys thereof, and combinations thereof” is new matter.

Applicants’ specification discloses that suitable barrier layers to deposit metal seed layers (e.g., copper) upon include cobalt, ruthenium, nickel, tungsten, tungsten nitride, titanium, titanium nitride, and silver (page 8, [0020]). Alloys and combinations thereof are not disclosed.

Claim 59

line 4, “ruthenium-containing” is new matter.

Applicants’ specification discloses that suitable barrier layers to deposit metal seed layers (e.g., copper) upon include cobalt, ruthenium, nickel, tungsten, tungsten

nitride, titanium, titanium nitride, and silver (page 8, [0020]). Ruthenium alloys are not disclosed.

II. Claims 8-10, 20-22, 31-33 and 37-59 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 8

line 3, it appears that “a barrier layer” is the same as the barrier material layer recited in claim 8, line 2. However, it is unclear if it is. See also claim 8, line 4.

line 7, it appears that “a copper solution” is -- a first copper solution -- because a second copper solution is recited in claim 8, line 16. However, it is unclear if it is.

line 12, it appears that “an electrical bias” is a -- a first electrical bias -- because a second electrical bias is recited in claim 8, line 18.

Claim 20

line 3, it appears that “a barrier layer” is the same as the barrier material layer recited in claim 20, line 2. However, it is unclear if it is. See also claim 20, line 4.

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Claim 22

line 2, “the first copper solution” lacks antecedent basis.

Claim 31

line 3, it appears that “a barrier layer” is the same as the barrier material layer recited in claim 31, line 2. However, it is unclear if it is. See also claim 31, line 4.

Claim 44

lines 1-3, recites that “the barrier layer **comprises** a material selected from the group consisting of cobalt, ruthenium, nickel, tungsten, tungsten nitride, titanium, titanium nitride, silver, alloys thereof, and combinations thereof”.

Claim 8, lines 4-6, already recites that “the barrier layer **has** a barrier surface selected from the group consisting of a tungsten surface, a tungsten nitride surface, a titanium surface, a titanium nitride surface, a cobalt surface, a ruthenium surface, a nickel surface, and a silver surface”.

It is unclear what is the relationship between what “the barrier layer comprises” and what the “barrier layer has”. How is the barrier layer of claim 44 further limiting the barrier layer of claim 8?

Claim 59

line 5, it appears that “a copper solution” is -- a first copper solution -- because a

second copper solution is recited in claim 59, line 11. However, it is unclear if it is.

line 7, it appears that "an electrical bias" is a -- a first electrical bias -- because a second electrical bias is recited in claim 59, line 13.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

I. Claims **8-9 and 37-44** are rejected under 35 U.S.C. 103(a) as being unpatentable over **Miura et al.** (US Patent Application publication No. 2003/0155247 A1) in combination with **Dubin et al.** (US Patent No. 6,432,821 B1) and **Wang et al.** (US Patent No. 6,528,412 B1).

Miura teaches a method for depositing a copper-containing seed layer (= reinforces the seed layer and adds thickness to the seed layer within the trenches or via holes) [page 4, [0051]] onto a barrier material layer (= a barrier layer) [page 3, [0049]], comprising:

(a) providing a substrate (= a silicon wafer) [page 3, [0046]] having a barrier layer disposed on a substrate surface, wherein the barrier layer has a barrier surface selected from the group consisting of a tungsten surface, a tungsten nitride surface, a titanium

surface, a titanium nitride surface, a cobalt surface, a ruthenium surface, a nickel surface, and a silver surface (= Ti, TiN, Ta, TaN, W and WN) [page 3, [0049]];

(b) exposing the substrate to a copper solution containing complexed copper ions (= salts of copper with the latter-described complexing agent are particularly preferred) (page 2, [0019] and [0020]) and having a pH value of less than 7 (= a pH of 4 to 10) [page 3, lines 0040]], wherein the complexed copper ions are derived from a copper source selected from the group consisting of copper citrate, copper borate, copper tartrate, copper oxalate, derivatives thereof, and combinations thereof (= citric acid) [page 2, [0023] and [0027]]; and

(c) applying an electrical bias across the substrate surface (page 4, [0053]) to chemically reduce the complexed copper ions (pages 4, [0051]).

The copper source is copper citrate (page 2, [0020], [0023] and [0027]).

The copper solution contains a copper concentration within the range from about 0.02 M to about 0.8 M (= 0.5 to 60 g/l) [page 2, [0021]].

The electrical bias generates a current density of less than about 10 mA/cm² across the substrate surface (= 0.1 to 4.0 A/dm²) [page 4, [0053]].

The current density is within the range from about 0.5 mA/cm² to about 3 mA/cm² (= 0.1 to 4.0 A/dm²) [page 4, [0053]].

The copper seed layer has a thickness less than about 200 Å (= 1 nm) [page 4, [0050]].

The pH value is within a range from about 4.5 to about 6.5 (= a pH of 4 to 10)

[page 3, lines 0040]].

The barrier layer comprises a material selected from the group consisting of cobalt, ruthenium, nickel, tungsten, tungsten nitride, titanium, titanium nitride, silver, alloys thereof, and combinations thereof (= Ti, TiN, Ta, TaN, W and WN) [page 3, [0049]].

The method described by Miura differs from the instant invention because Miura does not disclose the following:

- a. Wherein applying the electrical bias deposits a copper seed layer onto the barrier surface, as recited in claim 1.
- b. Wherein the copper seed layer is deposited on the entire barrier surface, as recited in claim 37.

Miura teaches that the seed layer is formed by depositing a layer of a highly conductive metal (e.g., copper) using PVD techniques such as sputtering and ion plating or CVD techniques (page 4, [0050]).

Miura teaches that the thickness of the seed layer can vary significantly with the thinnest part having a thickness less than half the average thickness (page 1, [0007]).

Miura teaches that the electrolytic copper plating solution of his invention reinforces the seed layer and adds thickness within the trenches or via holes of silicon wafers (page 4, [0051]).

Like Miura, Wang teaches forming a seed layer **122** by PVD. Wang teaches that

because the seed layer **122** is discontinuous when the seed layer **122** is too thin, a seed enhancement layer **130** is formed on the seed layer **122**. The seed enhancement layer **130** is a thinner layer of copper. The seed enhancement layer is formed by an ECD (electrochemical deposition) such that the seed enhancement layer **130** is conformal to continuously cover substantially all exposed surfaces within the interconnect opening **104** (col. 2, line 66 to col. 3, line 12; and Figs. 4 and 5).

The invention as a whole would have been obvious to one having ordinary skill in the art at the time the invention was made because the seed layer is discontinuous when the seed layer is thin as taught by Wang (col. 2, line 66 to col. 3, line 12; and Figs. 4 and 5).

The electrolytic copper plating disclosed by Miura (page 4, [0051]) would have applied an electrical bias to deposit a copper seed layer (= an enhancement seed layer) onto the barrier surface (See Figs. 4 and 5 of Wang) because the electrolytic copper plating solution of Miura reinforces the seed layer and adds thickness within the trenches or via holes of silicon wafers (page 4, [0051]). The copper seed layer would have been deposited on the entire barrier surface (See Figs. 4 and 5 of Wang).

c. Depositing a copper gap-fill layer by exposing the substrate to a second copper solution containing free-copper ions; and applying a second electrical bias across the substrate surface to deposit the copper gap-fill layer onto the copper seed layer, as recited in claim 1.

d. Depositing a bulk-fill copper layer by exposing the substrate to a third copper solution containing free-copper ions; and applying a third electrical bias across the substrate surface to deposit the copper bulk-fill layer onto the copper gap-fill layer, as recited in claim 9.

Like Miura, Dubin teaches filling an interconnect opening. Dubin teaches that a plating program in which an initiation, or seed layer repair, operation is performed by forcing a first forward current, a second forward current is then forced to superfill features less than 0.3 microns in width, and finally, a third forward current is forced to perform a bulk fill operation is a known conventional plating program for filling damascene structures (col. 3, line 66 to col. 4, line 10; and Fig. 2).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the method of Miura by depositing a copper gap-fill by exposing the substrate to a second copper solution containing free-copper ions; and applying a second electrical bias across the substrate to deposit the copper gap-fill layer onto the copper seed layer; and depositing a bulk-fill copper layer by exposing the substrate to a third copper solution containing free-copper ions; and applying a third electrical bias across the substrate to deposit the copper bulk-fill layer onto the copper gap-fill layer because Miura teaches that the trenches or via holes may be completely filled with copper using the electrolytic copper plating solution of his invention, or they may be first filled halfway and then applied with a highly acidic or highly basic copper plating solution to be filled completely. The electrolytic copper plating solution of his

invention reinforces the seed layer and adds thickness to the seed layer within the trenches or via holes of silicon wafers so that a highly acidic or highly basic copper plating solution, which would otherwise corrode the seed layer, can be used to plate the silicon wafer (page 4, [0051]).

Modifying the halfway fill to comprise a second forward current (and bias) and the complete fill to comprise a third forward current (and bias) would have eliminated thin seed layer dissolution and would have superfilled the smallest features first and then the largest features in order to provide the desired surface morphology as taught by Dubin (col. 3, line 66 to col. 4, line 10; col. 7, lines 12-38; and Figs. 2 and 7).

Furthermore, it has been shown that the transpositioning of varying steps, or varying the details of a process, as by adding a step or splitting one step into two does not avoid obviousness where the processes are substantially identical or equivalent in terms of function, manner and result. *General Foods Corp. v. Perk Foods Co.* (DC NIII 1968) (157 USPQ 14); *Malignani v. Germania Electric Lamp Co.*, 169 F. 299, 301 (D.N.J. 1909); *Matrix Contrast Corp. v. George Kellar*, 34 F.2d 510, 512, 2 USPQ 400, 402-403 (E.D.N.Y 1929); *Hammerschlag Mfg. Co. v. Bancroft*, 32 F. 585, 589 (N.D.III.1887); *Procter & Gamble Mfg. Co. v. Refining*, 135 F.2d 900, 909, 57 USPQ 505, 513-514 (4th Cir. 1943); *Matherson-Selig Co. v. Carl Gorr Color Gard, Inc.*, 154 USPQ 265, 276 (N.D.III.1967).

As to the copper solutions containing free-copper ions, free-copper ions are inherently present in a highly acidic or highly basic copper plating solution because it is

the copper ions that are deposited on the substrate to form the copper seed layer.

II. Claim 10 is rejected under 35 U.S.C. 103(a) as being unpatentable over **Miura et al.** (US Patent Application publication No. 2003/0155247 A1) in combination with **Dubin et al.** (US Patent No. 6,432,821 B1) and **Wang et al.** (US Patent No. 6,528,412 B1) as applied to claims 8-9 and 37-44 above, and further in view of **Nagai et al.** (US Patent No. 6,709,563 B2).

Miura, Dubin and Wang are as applied above and incorporated herein.

The method described by Miura, Dubin and Wang differs from the instant invention because they do not disclose wherein at least one leveling agent is added to the first copper solution to form the second copper solution, as recited in claim 10.

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the first copper solution described by Miura with wherein at least one leveling agent is added to the first copper solution to form the second copper solution because adding at least one leveling agent to the second copper solution would have retarded the growth of plating at the inlet of a fine recess and made it possible to fully fill the fine recess with copper uniformly without the formation of any void, and further flatten the plating surface as taught by Nagai (col. 17, line 64 to col. 18, line 2).

III. Claims 20-21 and 45-52 are rejected under 35 U.S.C. 103(a) as being

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unpatentable over **Miura et al.** (US Patent Application publication No. 2003/0155247 A1) in combination with **Dubin et al.** (US Patent No. 6,432,821 B1) and **Wang et al.** (US Patent No. 6,528,412 B1).

Miura, Dubin and Wang are as applied for reasons as discussed above and incorporated herein.

IV. Claim **22** is rejected under 35 U.S.C. 103(a) as being unpatentable over **Miura et al.** (US Patent Application publication No. 2003/0155247 A1) in combination with **Dubin et al.** (US Patent No. 6,432,821 B1) and **Wang et al.** (US Patent No. 6,528,412 B1) as applied to claims 20-21 and 45-52 above, and further in view of **Nagai et al.** (US Patent No. 6,709,563 B2).

Miura, Dubin, Wang and Nagai are as applied for reasons as discussed above and incorporated herein.

V. Claims **31-32 and 53-58** are rejected under 35 U.S.C. 103(a) as being unpatentable over **Miura et al.** (US Patent Application publication No. 2003/0155247 A1) in combination with **Dubin et al.** (US Patent No. 6,432,821 B1) and **Wang et al.** (US Patent No. 6,528,412 B1).

Miura, Dubin and Wang are as applied for reasons as discussed above and incorporated herein.

VI. Claim 33 is rejected under 35 U.S.C. 103(a) as being unpatentable over **Miura et al.** (US Patent Application publication No. 2003/0155247 A1) in combination with **Dubin et al.** (US Patent No. 6,432,821 B1) and **Wang et al.** (US Patent No. 6,528,412 B1) as applied to claims 31-32 and 53-58 above, and further in view of **Nagai et al.** (US Patent No. 6,709,563 B2).

Miura, Dubin, Wang and Nagai are as applied for reasons as discussed above and incorporated herein.

VII. Claim 59 is rejected under 35 U.S.C. 103(a) as being unpatentable over **Miura et al.** (US Patent Application publication No. 2003/0155247 A1) in combination with **Dubin et al.** (US Patent No. 6,432,821 B1), **Wang et al.** (US Patent No. 6,528,412 B1) and **Dubin** (US Patent Application Publication No. 2004/0108217 A1).

Miura, Dubin and Wang are as applied for reasons as discussed above and incorporated herein.

The method described by Miura, Dubin and Wang differs from the instant invention because they do not disclose wherein the barrier layer has a ruthenium-containing surface, as recited in claim 59.

Like Miura, Dubin teaches filling an interconnect opening. Dubin teaches that a barrier layer can include any one of the following materials: tantalum, tungsten, titanium, ruthenium, molybdenum, and their alloys with nitrogen, silicon and carbon (page 2, [0021]).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the barrier layer described by Miura with wherein the barrier layer has a ruthenium-containing surface because ruthenium is a conventional barrier layer material in that art which would have prevented the deposited copper from dispersing on the surface of the silicon wafer to alter the semiconductor characteristics as taught by Dubin (page 2, [0021]).

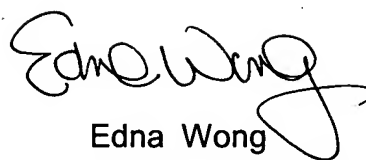
Any inquiry concerning this communication or earlier communications from the examiner should be directed to Edna Wong whose telephone number is (571) 272-1349. The examiner can normally be reached on Mon-Fri 7:30 am to 4:00 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nam Nguyen can be reached on (571) 272-1342. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

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Edna Wong
Primary Examiner
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EW
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